IN THE DRAWINGS

Amendments to the drawings.

Remarks/Arguments begin on page 2 of this document.

REMARKS

Reconsideration of this application is requested.

The applicant affirms the election with traverse of claims 1-29.

A replacement drawing in compliance with 37 CFR 1.121(b) is submitted herewith. The drawing is labeled "replacement sheet" as required pursuant to 37 CFR 1.84(c).

Claims 11-13 were objected to because of inconsistent terminology. These claims have been amended to be more consistent. No equivalence has been surrendered by these amendments.

The Examiner noted that the word "yttria" was misspelled in claims 12 and 26. These misspellings have been corrected in claims 12, 26, 27 and 34. Although claim 34 is not subject to examination, it is respectfully requested that the examiner enter the amendment to correct the spelling in claim 34.

Rejections under 35 U.S.C. §112

Claims 26 and 27 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failure to provide an antecedent basis for terms in the claims. The claims have been amended to provide antecedent basis for the terms in both claims 26 and 27. No equivalence has been surrendered by these amendments.

Claims Rejections under 35 U.S.C. §103

Claims 1-29 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. patent no. 4,313,013 to Harris in view of U.S. patent no. 5,980,989 to Takahashi et al.

In the Examiner's opinion, the Harris reference discloses palladium and certain alloys of palladium are selectively permeable to hydrogen and that the equilibrium of gas phase reactions in which hydrogen is a reactant or a product can be affected by the presence of such a hydrogen permeable membrane. The Examiner references the Harris patent at column 2, lines 4-13 which shows the conversion of paraffins to monoolefins. The Examiner then concludes that the same reaction would occur in the conversion of alkanes to alkenes, although the Examiner admits that the Harris reference fails to disclose the claimed metal oxide ceramic powder. By inference, the Examiner must also admit that the Harris patent does not show or suggest the claimed composite membrane of a sintered homogenous mixture of a metal oxide ceramic powder and a metal powder.

The Examiner has made the error of assuming that the reaction or conversion of paraffins to monoolefins is extendable to the conversion of alkanes to alkenes. This is an erroneous conclusion and one which causes the Examiner's logic to fail. Attached hereto is a copy of three pages from the Purdue Chemistry website showing that alkanes are generally inert to chemical reaction without the presence of a spark or high-intensity light source. Accordingly, the Examiner's theory of an equilibrium reaction between alkanes and alkenes is incorrect and cannot form the basis of an obviousness rejection based on §103.

To the inadequate Harris reference, the Examiner has added the Takahashi et al. reference for disclosing the palladium is used for hydrogen diffusion. What is shown or suggested in the Takahashi et al. reference is also insufficient in and of itself or combined with Harris to render obvious the present invention. The Takahashi et al. patent discloses the deposition of a palladium solution to form a gas separator but the combination disclosed in the Takahashi et al. reference is not the homogeneous composite sintered material of the claimed invention here. Rather, it is a peelable metal coating or layer deposited on an aluminum substrate. This is very different from the claimed material. Accordingly, it is suggested that no combination of the Harris patent or the Takahashi et al. patent would render obvious the claimed invention.

The Examiner stated

> "Takahashi et al discloses an inorganic porous support which would included the claimed yttria stabilized zirconia."

This statement is clearly erroneous. Whether the disclosure of a porous alumina substrate, or for that matter a porous substrate, used in a chemical plating technique "would include" the claimed material is immaterial because the Takahashi et al. patent does not <u>teach</u> the claimed yttria stabilized zirconia, a far different issue than whether a generalized term would include a claimed material. The Takahashi et al. patent is fatally defective in teaching either the claimed membrane or the metal oxide powder specifically disclosed.

Finally, the Examiner concluded that it would be obvious to one or ordinary skill in the art at the time the invention was made to modify the process of Harris by using a support for the

palladium alloy membrane as taught by Harris, but this statement assumes its own conclusion. Neither the Harris reference nor the Takahashi et al. reference remotely shows or suggests a composite membrane of a sintered homogeneous mixture of a metal oxide ceramic powder and a metal powder as specified in claims 1-29 at issue. Neither of the references remotely suggests that alkanes could be converted to alkenes by contacting alkanes with the claimed composite membrane. In the absence of any teaching of either the membrane or the conversion of alkanes to alkenes, the Examiner has totally failed to provide any reference on which a rejection under 35 U.S.C. §103(a) could be based. Accordingly, it is suggested that each of claims 1-29 as now presented, is drawn to patentable subject matter and the allowance is requested.

Double Patenting

The Examiner has rejected claims 1-29 as being unpatentable on the ground of non-statutory obviousness type double patenting in view of U.S. patent no. 6,569,226. A terminal disclaimer to the '226 patent is enclosed herewith, thereby obviating this rejection.

All matters having been attended to, it is respectfully suggested that this application is now in condition for action and such action is respectfully requested.

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Respectfully submitted,

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The Reactions of Alkanes, Alkenes, and Alkynes

Alkanes	Alkenes and Alkynes

Alkanes

In the absence of a spark or a high-intensity light source, alkanes are generally inert to chemical reactions. However, anyone who has used a match to light a gas burner, or dropped a match onto charcoal coated with lighter fluid, should recognize that alkanes burst into flame in the presence of a spark. It doesn't matter whether the starting material is the methane found in natural gas,

$$CH_4(g) + 2\ O_2(g) \longrightarrow CO_2(g) + 2\ H_2O(g)$$

the mixture of butane and isobutane used in disposable cigarette lighters,

$$2\ C_4H_{10}(g) + 13\ O_2(g) \longrightarrow 8\ CO_2(g) + 10\ H_2O(g)$$

the mixture of C_5 to C_6 hydrocarbons in charcoal lighter fluid,

$$C_5H_{12}(g) + 8\ O_2(g) \longrightarrow 5\ CO_2(g) + 6\ H_2O(g)$$

or the complex mixture of C_6 to C_8 hydrocarbons in gasoline.

$$2\ C_8H_{18}(l) + 25\ O_2(g) \longrightarrow 16\ CO_2(g) + 18\ H_2O(g)$$

Once the reaction is ignited by a spark, these hydrocarbons burn to form CO_2 and H_2O and give off between 45 and 50 kJ of energy per gram of fuel consumed.

In the presence of light, or at high temperatures, alkanes react with halogens to form **alkyl halides**. Reaction with chlorine gives an **alkyl chloride**.

$$CH_4(g) + Cl_2(g) \xrightarrow{\text{light}} CH_3Cl(g) + HCl(g)$$

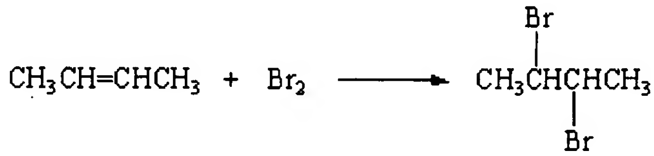
Reaction with bromine gives an **alkyl bromide**.

$$CH_4(g) + Br_2(l) \xrightarrow{\text{light}} CH_3Br(g) + HBr(g)$$

Return To Top of Page

Alkenes and Alkynes

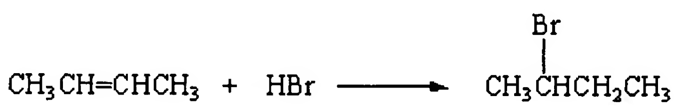
Unsaturated hydrocarbons such as alkenes and alkynes are much more reactive than the parent alkanes. They react rapidly with bromine, for example, to add a Br_2 molecule across the C=C double bond.



2,3-Dibromobutane

This reaction provides a way to test for alkenes or alkynes. Solutions of bromine in CCl_4 have an intense red-orange color. When Br_2 in CCl_4 is mixed with a sample of an alkane, no change is initially observed. When it is mixed with an alkene or alkyne, the color of Br_2 rapidly disappears.

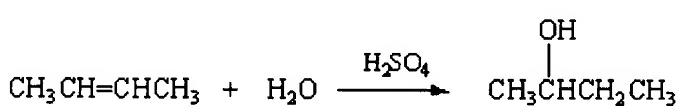
The reaction between 2-butene and bromine to form 2,3-dibromobutane is just one example of the **addition reactions** of alkenes and alkynes. Hydrogen bromide (HBr) adds across a C=C double bond to form the corresponding alkyl bromide, in which the hydrogen ends up on the carbon atom that had more hydrogen atoms to begin with. Addition of HBr to 2-butene, for example, gives 2-bromobutane.



2-Bromobutane

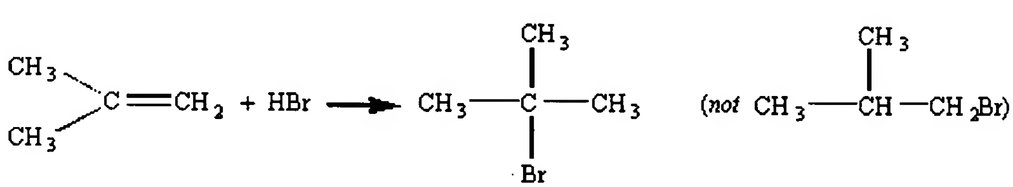
H_2 adds across double (or triple bonds) in the presence of a suitable catalyst to convert an alkene (or alkyne) to the corresponding alkane.

In the presence of an acid catalyst, it is even possible to add a molecule of water across a C=C double bond.

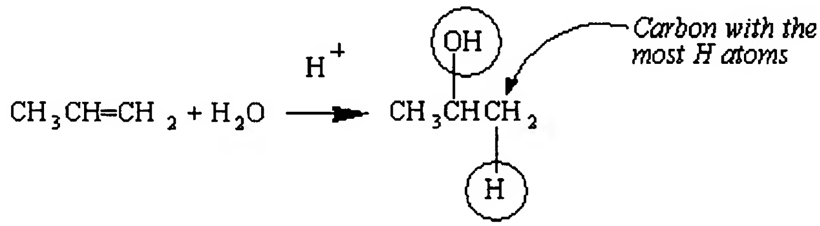


Addition reactions provide a way to add new substituents to a hydrocarbon chain and thereby produce new derivatives of the parent alkanes.

In theory, two products can form when an unsymmetric reagent such as HBr is added to an unsymmetric C=C double bond. In practice, only one product is obtained. When HBr is added to 2-methylpropene, for example, the product is 2-bromo-2-methylpropane, not 1-bromo-2-methylpropane.



In 1870, after careful study of many examples of addition reactions, the Russian chemist Valdimir Markovnikov formulated a rule for predicting the product of these reactions. Markovnikov's rule states that **the hydrogen atom adds to the carbon atom that already has the larger number of hydrogen atoms when HX adds to an alkene**. Thus, water (H — OH) adds to propene to form the product in which the OH group is on the middle carbon atom.



Return To Top of Page

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